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have tended to bring them closer to one another, we still find that of the thirty-six chief orders three claim an origin from the caliph Abūbekr, whom the Sunnites honour, and the rest from 'Alī, the idol of the Shī'ites.[1] Mystic absorption in the being of God, with an increasing tendency to pantheism and ascetic practices, are the main scope of all Ṣūfiism, which is not necessarily confined to members of orders; indeed the secret practice of contemplation of the love of God and contempt of the world is sometimes viewed as specially meritorious. And so ultimately the word *ṣūfī* has come to denote all who have this religious direction, while those who follow the special rules of an order are known as dervishes (beggars, in Arabic *faqarā*, sing. *faqīr* —names originally designating only the mendicant orders). In Persia at the present day a Ṣūfī is much the same as a free-thinker.[2]

BIBLIOGRAPHY.—The work of Shahrastānī (q.v.) on the Moslem sects: A. von Kremer, *Geschichte der herrschenden Ideen des Islams* (Leipzig, 1868); I. Goldziher, *Muhammedanische Studien*, vol. ii. (Halle, 1890); D. B. Macdonald, *Muslim Theology* (London, 1903); the *Hidaya* (trans. C. Hamilton, 2nd ed., London, 1870); N. B. E. Baillie, *A Digest of Muhammadan Law* (London, 1865); E. Sachau, *Muhammadanisches Recht nach Schafiitischer Lehre* (Stuttgart and Berlin, 1897); *El-Bokhari, les traditions islamiques* (trans. by Houdas and Marçais, Paris, 1903); Lane, *An Account of the Manners and Customs of the Modern Egyptians* (London, 1836). For the organization of the 'ulemā in the Ottoman Empire during the middle ages see E. J. W. Gibb, *A History of Ottoman Poetry*, ii. 394 sqq. (London 1902). (A. MU.; R. A. N.)

SUNSHINE. As a meteorological element sunshine requires some conventional definition. There is uninterrupted continuance of gradation from the burning sunshine of a tropical noon to the pale luminosity that throws no shadow, but just identifies the position and shape of the sun through the thin cloud of northern skies.

The Campbell-Stokes Sunshine Recorder.—In the British Isles the sun is allowed to be its own timekeeper and the scorch of a specially prepared card used as the criterion for bright sunshine. The practice arose out of the use of the sunshine recorder which depends upon the scorching effect of a glass sphere in the sun's rays. The original form of the instrument was suggested by J. F. Campbell of Islay in 1857. He used a glass sphere within a hemispherical bowl of wood. The scorching of the wood along successive lines of the bowl as the sun alters its declination from solstice to solstice leaves a rugged monument of the duration and intensity of the sunshine during the half-year, but does not lend itself to numerical measurement. The design of a metal frame to carry movable cards and thus give a decipherable record of each day's sunshine is due to Sir G. G. Stokes. The excursions of the sun to the north and south of the equator are limited by the tropical circles, and the solar record on the hemispherical bowl will be confined within a belt 23° 27′ north and south of the plane through the centre parallel to the equator or perpendicular to the polar axis. Thus a belt 46° 54′ in angular width will be suitable for a sunshine recorder for any part of the world. Whatever place be chosen for the observation the same belt will do if it is set up perpendicular to the earth's polar axis. But there can be no record if the sun is below the horizon; hence any part of the belt projecting above the horizon is not only useless for recording but is liable to shadow a part of the belt where there might be a record. Hence to meet the requirements of a particular locality the belt as set up round the polar axis should be cut in two by a horizontal plane through the centre and the half projecting above the horizontal removed. Reversed it makes a half belt, exactly similar to what is left, and thus each complete belt is cut by a horizontal plane through the centre into two frames suitable for sunshine recorders for the particular locality.

The cutting of the belt may, of course, vary between the direct transverse cut along the polar axis which gives a half-ring belt to be set vertical in order to receive the record for a point on the equator, and the cut perpendicular to the polar axis which divides the belt into two similar rings suitable for recording the sunshine at the poles. Clearly, when the belt is so cut that two complete rings are formed, a continuous record of sunshine throughout the twenty-four hours may be expected, so that for the polar circles the cut will run diagonally between opposite points of the extreme circles of the sun's records. As examples of the cutting of the belt for different latitudes we may put side by side the recorder as used in temperate latitudes (fig. 1) and

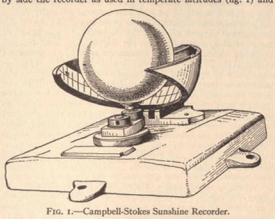
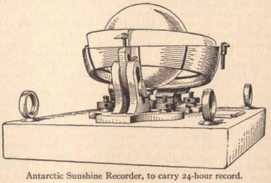


FIG. 1.—Campbell-Stokes Sunshine Recorder.

the special form designed in the Meteorological Office, London, for use on the National Antarctic Expedition, 1901–1904 (fig. 2). A belt cut for a particular latitude is serviceable for some 10°



Antarctic Sunshine Recorder, to carry 24-hour record.

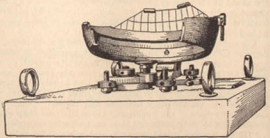


FIG. 2.—Antarctic Sunshine Recorder, to carry 12-hour record.

on either side of that latitude if the cards are not trimmed too closely to the cutting of the belt. The belt must always be adjusted round the parallel to the polar axis. If the cut of the belt is too oblique for the latitude of the place where it is exposed, and the cards are cut strictly to the belt, the northern side of the cut will be below the horizon and the southern side above it,

[1] These claims to early origin are mere fables, like the claim of the Oweisī order to spring from Oweis, one of the oldest traditionalists, and so forth.

[2] For the dervish orders see DERVISH.

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of leaf when fully developed (4 to 9 ins. in length and 2 to 3½ in breadth) has made them in demand because of the heavy yields. From the variety Bohea, or from hybrids of descent from it, came the China teas of former days and the earlier plantings in India grown from imported China stock. The

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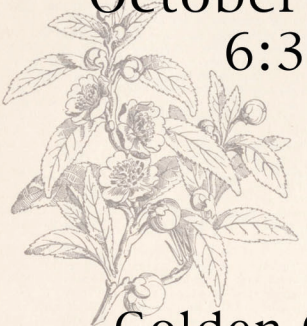

Fig.

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leaves of this variety are generally roughly speaking about half the

sorts. The

The latter is a tree attaining in its natural conditions, or where allowed to grow unpruned in a seed garden, a height of from 30 to 40 ft. and prospering in the midst of dense moist jungle and in shady sheltered situations.

Fig. 2.—Bohea Tea-leaf, full size.

The Bohea variety is hardy, and capable of thriving under many different conditions of climate and situation, while the indigenous plant is tender and difficult of cultivation, requiring for its success a close, hot, moist and equable climate. In minute structure it presents highly characteristic appearances.

The under side of the young leaf is densely covered with fine one-celled thick-walled hairs, about 1 mm. in length and ·015 mm. in thickness. These hairs entirely disappear with increasing age. The structure of the epidermis of the under side of the leaf, with its contorted cells, is represented (×163) in fig.

the cellular structure of the tea-leaf is

smooth cells (idioblasts) they occur in other

in such as are likely to be confounded with

for tea. The minute structure of the leaf in section is illustrated in fig. 4.

Constant controversy has existed as to what is the actual original home of the tea-plant, and probably no one has given to the subject more careful study than Professor Andreas Krassnow, of Kharkoff University. By order of the Russian government, he visited each of the great tea-growing countries, and the results of his observations were published in a book entitled *On the Tea-producing Districts of Asia*. He holds the opinion that the tea-plant is indigenous, not to Assam only, but to the whole monsoon region of eastern Asia, where he found it growing wild as far north as the islands of southern

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two distinct

Assam and Chinese, as he

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vation has been too short to produce the differences that exist between them.

Chemistry.—What may be termed the chemistry of production, ng to soils, manures, manufacturing processes, &c., ears received great attention from the scientific

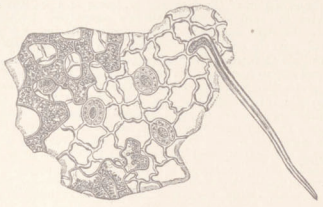

Fig. 3.—Epidermis of Tea-leaf (under side). ×160.

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to adequate scientific study. There cannot be said to be any standard or recognized analysis. Many such have been made, and they may be found in chemical

s, because of the

the chemical

the matter in the United States of America and in Germany and Russia than in England, but the infinite variety of samples known to the commercial expert, and the impossibility of standardizing those in such a manner as to make readily recognizable what the chemist has treated, renders most of the recorded analyses of uncertain value. There seems to be no relationship between the commercial value and the analysis, the arbitrary personal methods of the expert tea-taster being controlled by factors that chemistry does not appear to deal with. One reason may be that analyses are generally made of tea liquors produced by distilled water, which is the very worst possible from the point of view of the commercial expert or in domestic usage.

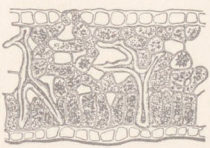

Fig. 4.—Section through Tea-leaf.

The principal chemical constituents of tea of practical interest are: caffeine, tannin and essential oil, on which depend respectively the physiological effects, the strength and the flavour. The commercial value appears to depend on the essential oil and aroma, not on the amount of caffeine, tannin or extract.

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l analysis of an average

	Per cent.
	24
	4
	20
and wax	2
	3
	10
Essential oil	0·75
Resin	3
Mineral matter (ash)	6
Moisture	7
Extractive matter	20·25
	100

Also a trace (·1 to ·2 per cent.) of boheic acid, a vegetable acid peculiar to tea. The amount of tannin found in green teas appears to be

about half as much again as in black, and the former always yield less nitrogen, doubtless because the harder fibre produced by the method of manufacture and the frequent use of a facing medium. A large percentage of moisture found in any sample would indicate improper condition. At the stage of final firing, tea is supposed to be desiccated as completely as possible, and it is then sealed up to exclude air entirely. It is, however, most liable to absorb moisture upon subsequent exposure. Caffeine (formerly known as theine) is the alkaloid of tea, and is identical with that of coffee, guarana, mate and kola nut. It is closely allied to *theobromine*, the alkaloid of cocoa, and also to uric acid. In large quantities it is a poison, but in smaller quantities it acts as a stimulant. It exists in greater percentage in Indian and Ceylon teas than in those from Java, and is lowest in China and Japan teas. Tannic acid is the principal astringent substance. Theophylline exists in the seeds and leaves. Professor Jamieson increases the amount extracted. The essential oil of tea, which is developed during the curing process, is said to possess [illegible] 40 per cent., and is no guide to quality. Ash averages 5·7 per cent., about half of which is soluble in water. A high percentage of ash is proof of adulteration.

Commercial.—There is probably no article of commerce which has undergone the changes in its methods of distribution that have characterized the tea trade during the past century. [illegible] In 1834 the East India Company's monopoly was abolished, and the trade was thrown open to all British subjects. [illegible] In 1854 the Company's last ship sailed from China, and the [illegible] in Great Britain and Holland. Formosa and Japan were becoming [illegible] tea, and the [illegible] of sailing ships from China had not entirely passed, and the steamers of the period were built for rapidity of transit to London. The Australasian colonies got their supplies direct, and part of the Russian supplies went by the caravan routes.

By 1907, however, the greatly increased production in India and Ceylon, with the willingness of the nations to drink such teas in preference to those of China, had left to her Russia as a customer for nearly half her export of the article, a proportion rapidly diminishing, as that country too turned in the direction of using the stronger varieties.

China and Japan have hitherto been regarded as the chief producers of tea, and the [illegible] Mongolian peoples has [illegible] ductions. There exist [illegible] whether such [illegible] mates. In both [illegible] retail manner, and much of it simply for family consumption. The country cultivator [illegible] corner of his farm [illegible] which is roughly sun-dried and cured in a primitive manner. Any surplus not needed for the family is sold in its sun-dried state to the collector, who takes it to the *hong*, where it is fired, blended and packed for exportation. Excluding therefore from any record the quantities produced for internal consumption in China and Japan (that from the former alone has been estimated at a total of 2,000,000,000 lb), the following are the acreage and production of the world as taken from the latest recorded statistics available in 1908:—

	Acreage under tea.	Production.
		lb
China	[illegible]	188,370,000
"	(Brick tea for Tibet) [1]	19,000,000 [2]
Japan	121,200	39,720,000 [2]
Formosa	[illegible]	only [illegible]
India	393,000	394,000,000
" (Burma)	11,000	8,249,000
Shan States	(mostly miscellaneous) [1]	[illegible]
Ceylon	508,000	250,000,000
Java	[illegible]	[illegible]
Natal	[illegible]	750,000

The quantity from China includes about 16,000,000 lb imported from India, Ceylon and Java, which are [illegible] teas into bricks and tablets.

The modern developments of production and consumption have rendered the subject of China tea one of subordinate interest, except to students of commercial evolution. In several of the earlier editions of this work very ample details are furnished regarding the same, with many interesting pictorial illustrations of the processes of production. The conservative tendencies of the Chinese people have prevented them adopting the modern methods of extensive cultivation based on scientific principles, and the manipulation of crops by machinery in place of hand labour. Consequently, their export trade has been for many years a diminishing one. Of the exported quantity referred to above, only 81,000,000 lb were the ordinary black tea known to the English consumer (collectively described in the United States of America and Canada as "English Breakfast Tea"). Out of that total, Great Britain consumed only about 54,000,000 lb, against a consumption of 126,000,000 lb of China tea in 1879. Green tea is represented by 28,000,000 lb, and this went chiefly to the United States of America, to Central Asia and to North Africa. The remainder, 80,000,000 lb, is brick and tablet tea sent entirely to Asiatic and European Russia. The method of compressing tea into tablets or bricks is unfamiliar in western Europe. It doubtless arose from the necessity of reducing bulk to a minimum for conveyance by caravan across the great trade routes of Asia, and now that the railway and the steamship have supplemented more primitive methods of transit, the system is still continued to meet the wants of the consumer who would not recognize the [illegible] Chinese hands. The Russians have themselves established several important factories [illegible] to which [illegible] broken tea from India, Ceylon and Java [illegible] are freely used in the preparation of the tablets [illegible] commonly passed round as [illegible] In certain districts of China, [illegible] of somewhat different [illegible] [illegible] on, M.A., was sent in 1906 as a special commissioner for the [illegible] which would not be packed for manufacturing purposes in India or Ceylon. It is "panned," rolled, fermented and divided into various classes or qualities. It is then steamed and placed in a moulding frame of wood to compress it into the size and shape of brick wanted. The bricks are wrapped in paper bearing marks, or some covering of [illegible] For transportation they are packed together in hides sewn up while moist, which contract to make a strong tight package of 60 to 70 lb weight. These bales are carried on the backs of coolies for great distances across very high passes into Tibet, and the trade is estimated at an average of 19,000,000 lb per annum, of which 8,000,000 is a subsidy from the emperor of [illegible] [illegible] entirely green tea for North [illegible] [illegible] [illegible]

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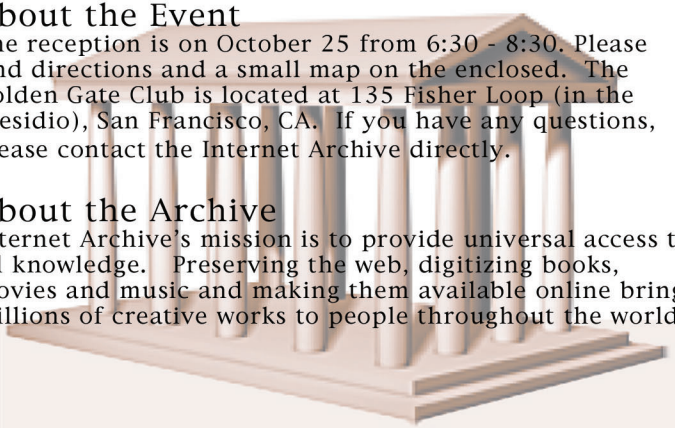

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